

Basewide Energy Systems Plan For Fort Gillem, Georgia

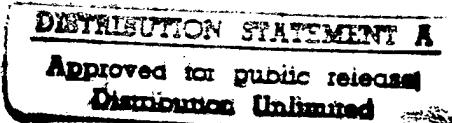
Final Report

Executive Summary

Facilities Engineer

Prepared For: Conservation Measures

**Savannah District
Corps of Engineers**



Prepared By:

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July 1985

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BASEWIDE ENERGY SYSTEMS PLAN
FOR
FORT GILLEM, GEORGIA

FINAL REPORT
EXECUTIVE SUMMARY
INCREMENTS A, B, F, AND G

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EXECUTIVE SUMMARY

1. INTRODUCTION

This report presents the results of Increments A, B, F, and G of the Energy Engineering Analysis Program conducted at Fort Gillem, Georgia, by JRB Associates under Contract No. DACA21-80-C-0014. This report includes analyses of the energy patterns at the facility, and the identification and evaluation of energy conservation opportunities. The results obtained indicate that current energy use at Fort Gillem has risen 80 percent over FY 1975 figures. This report is organized into 4 volumes plus appendices.

2. EXISTING ENERGY USE

Electricity, natural gas, and fuel oil are the main energy sources at Fort Gillem. In FY 1975 the total energy use at the Post was 233,700 MBtu. A summary of the FY 1984 basewide energy use and forecast 1985 by fuel type is given in Table 1, which shows that electricity currently accounts for approximately 66 percent of total energy use. Total energy use at the Post for the years 1975 to 1984 is shown in Table 2.

Early work in this study emphasized energy use in buildings. Initial data for the study were gathered through a series of site visits during which buildings were inventoried, patterns of building energy use were identified, and typical buildings were selected for detailed study in each category. Energy use data was analyzed to determine how much energy the various types of buildings use and their functional energy use. Since this effort took place in 1980, FY 1979 energy use data was the basis of the analysis. Figures 1, 2, 3, and 4 provide a summary of the building inventory and energy use in FY 1979. The energy profiles in these figures were developed by evaluating the energy use of typical buildings and expanding those values to represent the entire Post.

3. ENERGY CONSERVATION MEASURES DEVELOPED

The energy conservation opportunities at Fort Gillem are summarized in Table 3. This table shows all projects recommended and the resulting economic

TABLE 1. ENERGY USE AT FORT GILLEM - FY 1984

ENERGY SOURCE	PURCHASED ENERGY	SOURCE USE
Electricity	24,256,000 kWh	281,370 MBtu
No. 2 Fuel Oil	50,600 gallons	7,018 MBtu
Natural Gas	1,332,437 therms	133,244 MBtu

TABLE 2. ANNUAL ENERGY USE AT FORT GILLEM - FY 1975 - 1984 (MBtu)*

ENERGY SOURCE	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
Electricity	177,000	177,000	186,005	183,930	198,184	224,799	258,949	281,370
No. 2 Fuel Oil	38,000	57,000	68,219	--	--	85,695	108,076	133,244
Natural Gas	125,000	131,000	121,643	99,745	95,571	95,851	6,713	7,018

SOURCE: Facilities Engineers, Fort Gillem, GA, written communication

*FY 1975 total use 233,700 MBtu - use by individual energy source was not available.

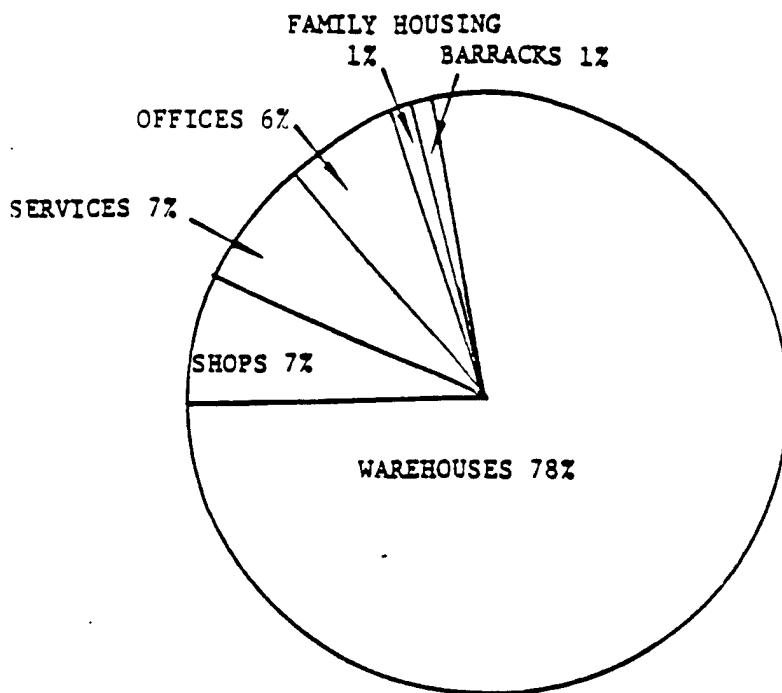


FIGURE 1. FLOOR AREA PROFILE BY BUILDING CATEGORY (FY 1979)

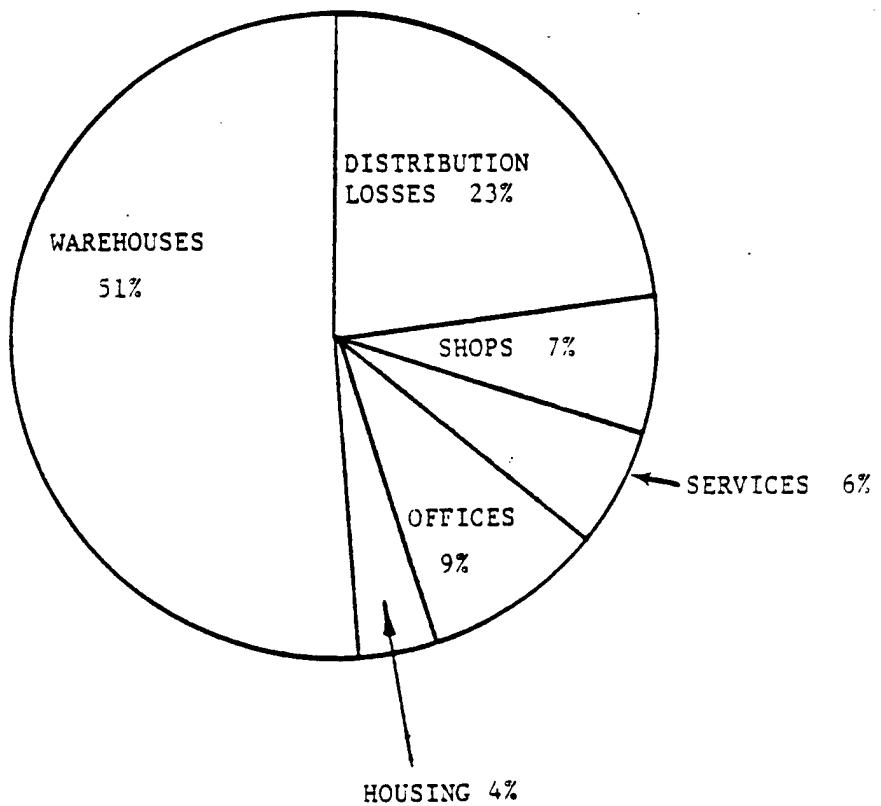


FIGURE 2. ENERGY USE BY BUILDING CATEGORY (FY 1979)

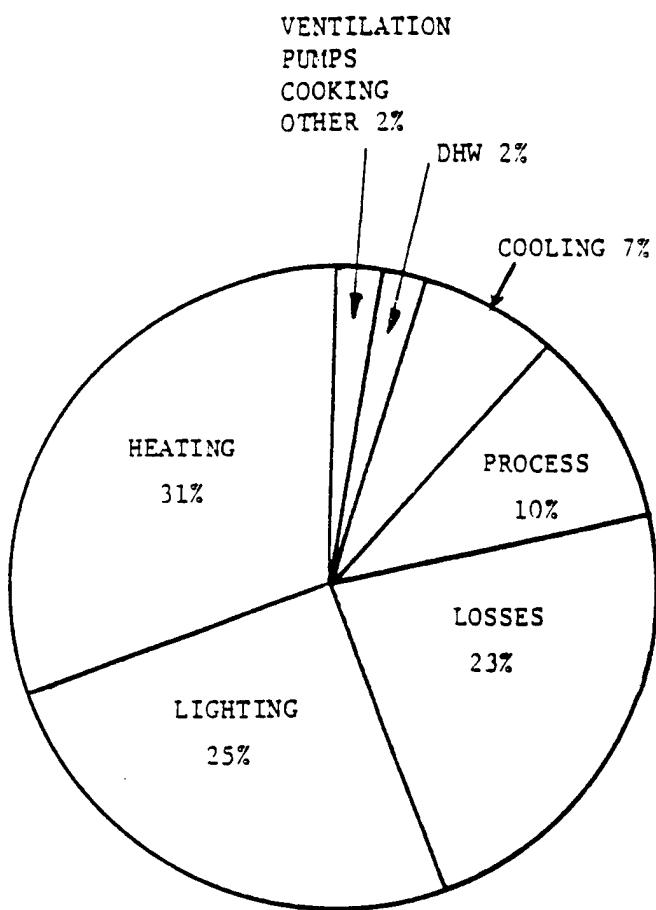


FIGURE 3. ENERGY USE BY BUILDING SYSTEM (FY 1979)

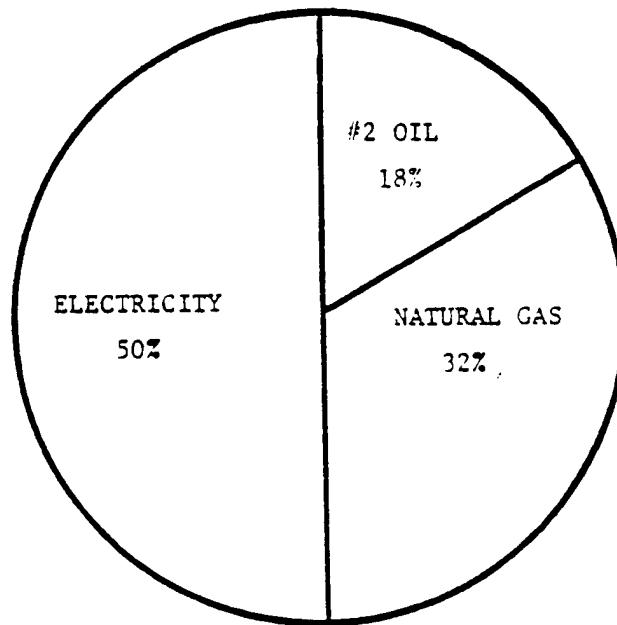


FIGURE 4. ACTUAL ENERGY USE (FY 1979)

TABLE 3. ENERGY CONSERVATION OPPORTUNITIES - FORT GILLEM

INCREMENTAL PROJECT DESCRIPTION	ECONOMIC INDICIES				ENERGY SAVINGS (MBTU FUEL OIL NAT. GAS ELEC.)	TOTAL	CWE SAVINGS (\$)	ANNUAL SAVINGS (\$)
	E/C	SIR OR B/C*	PAYOUT (YRS)	CATEGORY				
P REDUCE STRATIFICATION HEAT LOSSES	---	20.1	1.20	QRIP	---	2,074	-143	1,931
P REDUCE INFILTRATION	---	15.8	1.50	QRIP	---	1,975	---	1,975
G TEMPERATURE SETBACK: FAMILY HOUSING UNITS	216.0	14.9*	0.8	06M	---	128	---	128
P SHOWER FLOW RESTRICTORS	---	14.2	1.60	QRIP	---	407	333	740
F ENERGY CONSERVING FLUORESCENT LAMPS (EACH)	---	5.7	3.50	06M	---	---	0.15	0.15
A REDUCE TEMPERATURE STRATI- FICATION	---	5.2	3.90	ECIP	111,533	5,156	-1,761	14,928
G HIGHER EFFICIENT LIGHT SOURCES: F.H., BARRACKS, GYM	61.7	5.1*	3.36	06M	---	---	371	371
F ELECTRONIC BALLASTS (EACH)	---	4.8	1.70	06M	---	---	2.1	12.00
P HEAT RECOVERY FROM A/C (DESUPERHEATERS)	---	4.6	5.10	06M	---	569	---	569
A LOADING DOCK CURTAINS	---	3.6	3.72	ECIP	8,937	5,958	---	14,895
A ENERGY CONSERVATION OPPOR- TUNITIES FOR VARIOUS BUILDINGS	26.7	2.6*	6.10	ECIP	48	4,678	2,050	6,776
A CEILING INSULATION	17.0	2.2*	8.73	ECIP	143	1,838	34	2,015
P HIGH EFFICIENCY MOTORS (EACH)	1.8	5.20	06M	---	---	20	20	233
G STORM WINDOWS: F.H.	14.9	1.6*	11.99	06M	---	138	---	138
G REPLACE PILOTS WITH SPARK IGNITION: F.H.	16.6	1.2*	10.79	06M	---	18	---	18
A SECURITY LIGHTING**	---	.3	9.40	NR	---	---	2,313	2,313
TOTAL	20,661	22,939	884			44,484	1,194,275	285,663

* THIS DESIGNATES B/C VALUE
** THIS REVISED ECIP NO LONGER MEETS ECIP CRITERIA AND IS NOT RECOMMENDED FOR IMPLEMENTATION.
VALUES SHOWN ARE NOT INCLUDED IN TOTALS

1 - 50 HOURS/WEEK OPERATION - REPLACE AT FAILURE - NOT INCLUDED IN TOTALS
2 - 2 BULB 40 WATT FIXTURE AT 168 HOURS/WEEK OPERATION - REPLACE AT FAILURE - NOT INCLUDED IN TOTALS
3 - 25 hp MOTOR AT 50 HOURS/WEEK USE - REPLACE AT FAILURE - NOT INCLUDED IN TOTALS

indices. These energy conservation opportunities were developed by analyzing their applicability to typical buildings. Those that met ECIP criteria were developed into projects with appropriate documentation (DD Forms 1391 and PDB). Table 4 provides a listing of the recommended ECIP projects. Other recommended energy conservation projects identified by JRB are listed in Table 5.

4. ENERGY AND COST SAVINGS

The total energy savings potential of the recommended energy conservation projects is 44,484 MBtu per year. This represents an estimated energy cost savings of \$285,600.

5. RESULTS OF INCREMENT A - BUILDINGS

The scope of Increment A included an engineering analysis of all existing buildings and processes at Fort Gillem. For each type of building, specific characteristics having a significant effect on energy use were identified. Table 6 shows these characteristics. The energy use of these buildings is identified in that table. Based upon these analyses, energy conservation projects were evaluated using ECIP criteria to determine acceptability. The recommended ECIP projects developed under Increment A are identified in Table 4.

6. RESULTS OF INCREMENT B - DISTRIBUTION SYSTEMS, EMCS

The scope of Increment B involved an engineering analysis of the Post's utilities, energy distribution systems, the existing plants, and the potential for an EMCS. Load profiles for each energy source were performed. The annual energy use profiles for fossil fuels and electricity are presented in Figures 5 and 6. No projects for Fort Gillem were found under this study as the central boiler plants are relatively small, and energy conservation measures are usually economical only in large systems. In addition, an EMCS project was not recommended because it would be applicable only to a limited number of buildings (less than 20).

TABLE 4. ENERGY CONSERVATION INVESTMENT PROGRAM PROJECTS

INCREMENT	PROJECT DESCRIPTION	E/C	SIR OR B/C*	PAYBACK (Yrs)	FUNDING CATEGORY	TOTAL (MBtu)	CWE (\$)	ANNUAL SAVINGS (\$)
A	Loading Dock Curtains	--	3.6	3.7	ECIP	14,895	344,176	92,637
A	Reduce Temperature Stratification	--	5.2	3.9	ECIP	14,928	412,698	106,976
A	Energy Conservation Opportunities for Various Buildings	26.7	2.6*	6.1	ECIP	6,776	253,499	41,526
A	Ceiling Insulation	17.0	2.2*	8.73	ECIP	2,015	118,863	13,609
A	Security Lighting**	--	0.8	9.40	--	2,313	120,693	7,790
	TOTAL					38,614	1,132,236	254,748

*This designates B/C value.

**This revised ECIP no longer meets ECIP criteria and is not recommended for implementation.
Values shown are not included in totals.

TABLE 5. INCREMENT G CONSERVATION INVESTMENT PROGRAM PROJECTS

PROJECT DESCRIPTION	SIR OR B/C*	PAYBACK (Yrs)	TOTAL (MBtu)	GWE (\$)	ANNUAL SAVINGS (\$)
Temperature Setback: Family Housing Units	14.9*	0.8	128	591	714
Higher Efficient Light Sources: F.H., Barracks, Gym	5.1*	3.36	371	6,018	1,786
Storm Windows: F.H.	1.6*	11.99	138	9,275	774
Replace Pilots with Spark Ignition: Family Housing	1.2*	10.79	18	1,086	101
TOTAL			655	16,920	3,375

*This designates B/C value.

TABLE 6. FORT GILLEM BUILDING SUBGROUPS

CATEGORY	SUBGROUP	TYPICAL BUILDING	AREA IN SUBGROUP (square feet)	WALL TYPE
A. Offices	A-1	101	109,691	Brick Brick Wood Wood
	A-2	102	38,475	
	A-3	841	19,430	
	A-4	906	66,135	
Subtotal			233,731	
B. Dining*				
C. Housing	C-1	139	24,423	Brick Wood
	C-2	804	48,530	
	Subtotal		72,953	
D. Warehouses	D-1	308	293,932	Block Brick Brick
	D-2	309	1,623,723	
	D-3	507	1,206,371	
	Subtotal		3,124,026	
E. Shops	E-1	110	32,509	Brick Block Metal
	E-2	400	104,078	
	E-3	922	144,351	
	Subtotal		280,938	
F. Other	F-1	133	17,156	Block Brick Wood Block Wood
	F-2	207	191,997	
	F-3	918	18,079	
	F-4	935	35,308	
	F-5	942	8,407	
	Subtotal		270,947	
TOTAL			3,982,595	

* No troop dining facilities exist at Fort Gillem. Clubs and snack bar facilities were included in Category F

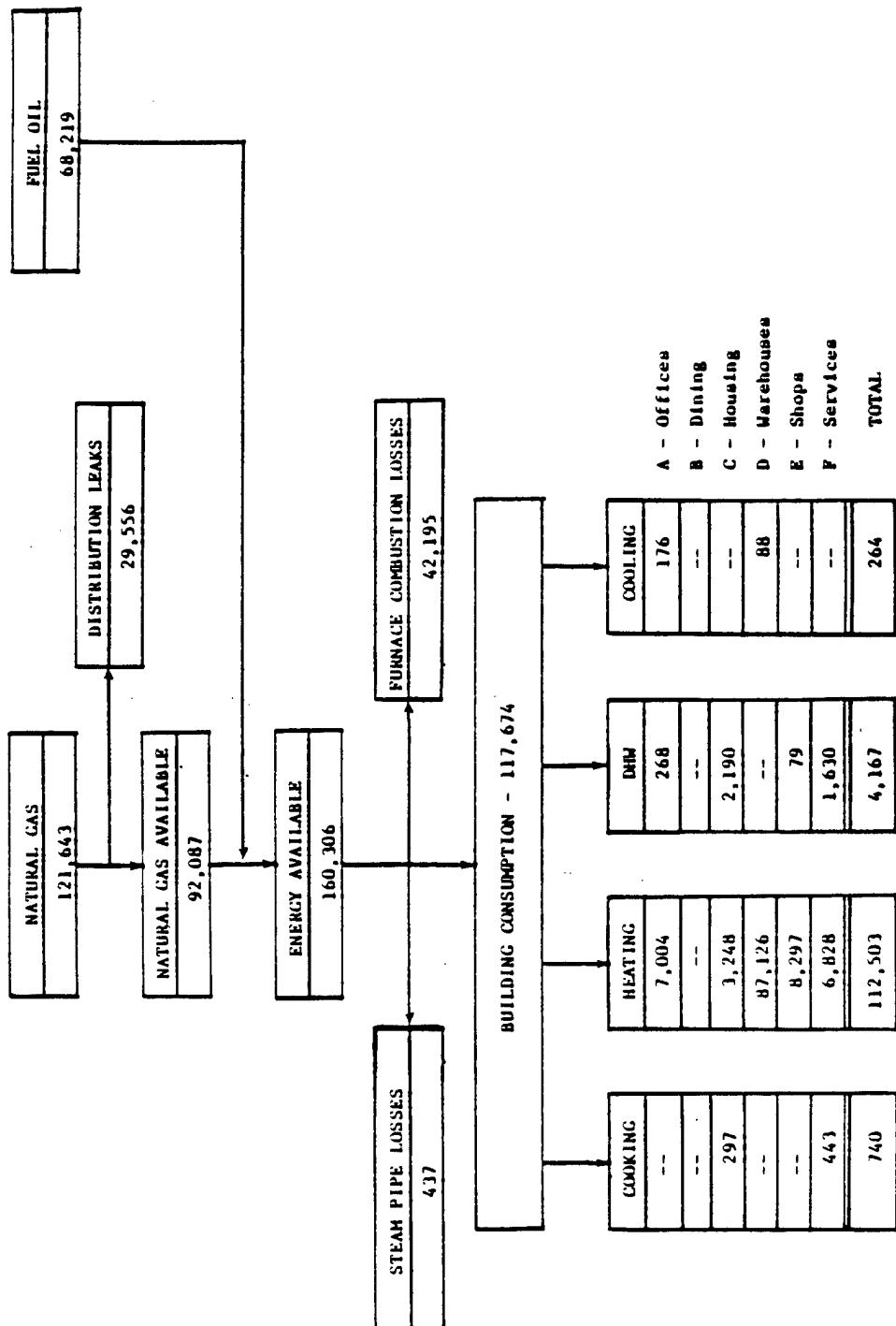


FIGURE 5. BUILDING ENERGY USE OF NATURAL GAS AND FUEL OIL BY BUILDING ENERGY SYSTEM
 (Reference Appendix D, Increment A report)

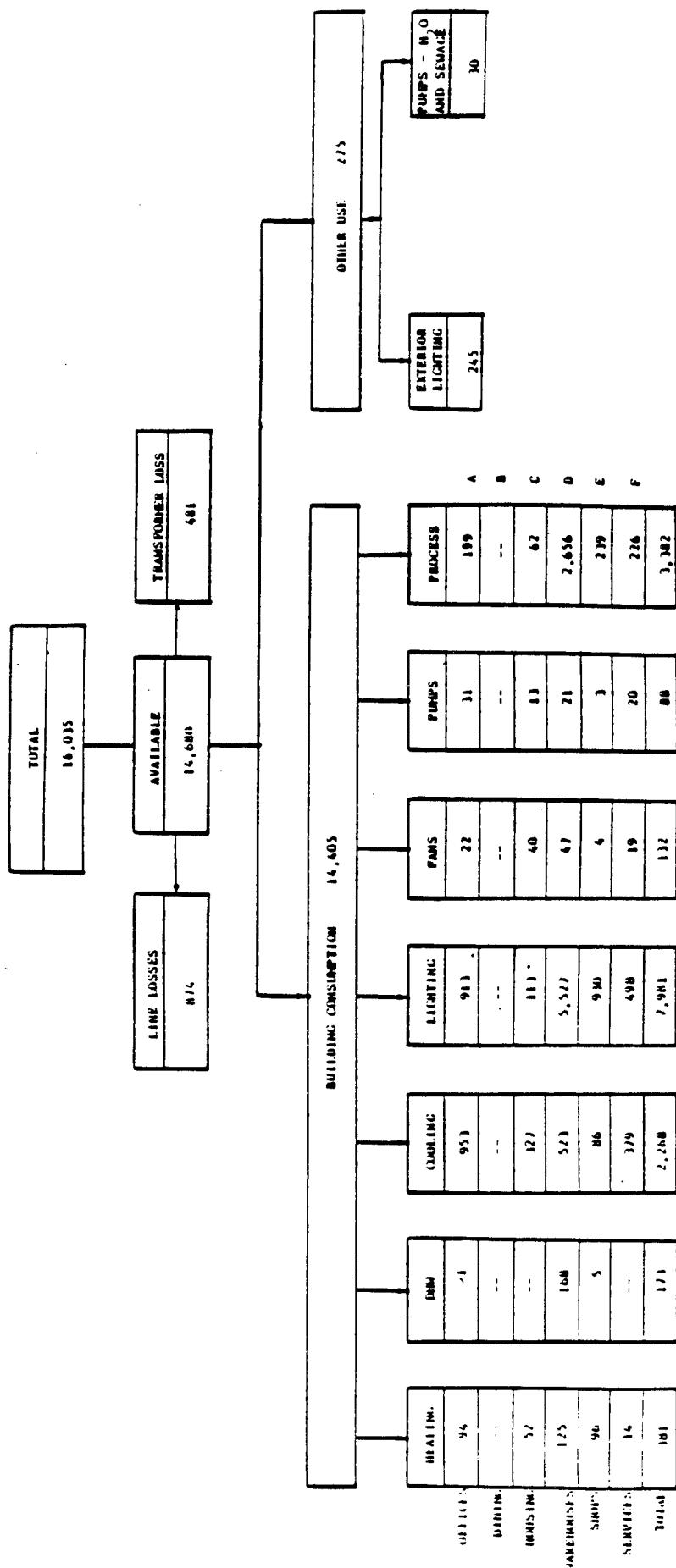


FIGURE 6. BUILDING ENERGY USE OF ELECTRICITY (In $\text{kWh} \times 10^3$ Per Year)

7. RESULTS OF INCREMENT F - FACILITY ENGINEER CONSERVATION MEASURES

The scope of work under Increment F is the identification of energy conservation opportunities that are within the Facilities Engineer funding authority, or which satisfy QRIP, OSD PIF, or PECIP requirements. In the performance of the Increment F evaluation, 19 buildings on Post were evaluated and four infiltration tests were performed.

Another element of the Increment F report is to identify the energy conservation measures accomplished by the Post since 1975. There were two major energy conservation actions taken by the Post. These are:

- Shutdown of major heating, lighting, and cooling systems when buildings are not in use; and
- Shutdown of utilities in unoccupied buildings.

These actions have resulted in a significant energy-use reduction. The recommended Increment F projects are presented in Table 7.

8. RESULTS OF INCREMENT G - MINOR CONSTRUCTION PROJECTS AND CHANGES IN OPERATION AND MAINTENANCE

The scope of work for Increment G was to identify cost-effective energy saving projects which do not qualify for ECIP funding. Increment G work was performed in conjunction with Increments A and B. The recommended projects are listed in Table 5.

9. ENERGY PLAN

A summary of the impact of JRB-recommended energy conservation projects and future Post actions on annual energy use is presented in Table 8. The estimated annual energy use increase comparing FY 1975 values to FY 1985 is 80 percent. Table 9 shows FY 1985 projected energy use by fuel type.

A comparison of annual energy use per square foot of Fort Gillem floor area is shown in Table 8. The projected percent change from FY 1975 to FY 1985 is a 21 percent decrease.

TABLE 7. RECOMMENDED ENERGY CONSERVATION OPPORTUNITIES AT FORT GILLEM

ENERGY OPTION	FUNDING	COST (\$)	ENERGY SAVINGS (MBtu)	ANNUAL COST SAVINGS (\$)	SIR	SIMPLE PAYBACK PERIOD (YEARS)
Reduce Stratification Heat Losses	QRIP	12,848	1,931	11,036	20.1	1.2
Reduce Infiltration	QRIP	15,257	1,975	11,258	15.8	1.4
Shower Flow Restrictors	QRIP	4,279	740	3,069	14.2	1.4
Energy Conserving Fluorescent Lamps (each)	O&M	1.20*	0.15*	0.67*	5.7	3.5
Electronic Ballasts (each)	O&M	12.00*	2.1*	7*	4.8	1.7
Heat Recovery from A/C (Desuperheater)	O&M	15,685	569	3,083	4.6	5.1
High Efficiency Motors (each)	O&M	233*	20*	45*	1.8	5.1
TOTAL		48,069	5,215	28,446		

*Not included in totals.

¹50 hours/week operation - replace at failure.

²Two bulb 40 watt fixture at 168 hours/week operation - replace at failure.

³25 hp motor at 50 hours/week use - replace at failure.

TABLE 8. ENERGY USE, ACTUAL AND PROJECTED, WITH PERCENTAGE OF INCREASE

FY	1975	1982	1983	1984	% INCREASE FROM 1975 (OVER 1984)	PROJECTED USE 1985	% INCREASE FROM 1975
Energy Use 10 ⁶ Btu/yr	233,700	406,345	373,738	421,632	80.4	421,146	80.2
Square Feet (x10 ³)	6,413	--	--	5,082	-20.8	5,066	-21.0
Energy (10 ⁶) Use per sq.ft.	0.0264	--	--	0.0830	128.0	0.0831	128.4

TABLE 9. FORECAST ENERGY USE BY FUEL TYPE

FUEL TYPE	1984 ENERGY USE (MBtu)	ENERGY REQUIRED BY NEW CONSTRUCTION (MBtu)	DEMOLITION (MBtu)	1985 FORECAST (MBtu)
Electricity	281,370	--	(-355)	281,015
Natural Gas	133,244	--	(-131)	133,113
#2 Fuel Oil	7,018	--	0	7,018
Total	421,632	--	(-486)	421,146

10. RESULTS AND RECOMMENDATIONS

The quantity of energy use at Fort Gillem will continue to increase as long as warehouse space is converted to other type space requiring more comfortable temperatures. These trends can be reversed by accomplishing several major actions. They are:

- Maintain the current energy conservation program at the Post level;
- Continue to program and fund major energy conservation projects;
- Perform a leak test on natural gas mains; and
- Install meters on all tenant activities and bill according to use.

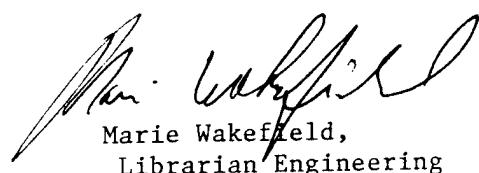


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